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Investigation of Application of ERTS-A Data to Integrated State Planning in Maryland

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PREFACE

This investigation represents a joint effort between the Maryland Department of State Planning and Earth Satellite Corporation. The primary objective is to evaluate and demonstrate the utility of satellite and aircraft remotely sensed data to integrated processes of comprehensive state planning. The project is being conducted in the State of Maryland. Remotely sensed data are being evaluated for their applicability to land use inventory and updating evaluation of land capability and land use suitability. Remotely sensed data are being integrated with other data used in state planning processes to demonstrate its applicability within the context of state planning methods. Results to date indicate that both satellite (ERTS-1) and aircraft imagery provide information which is both useful and acceptable to the state planning community, locally as well as regionally, and at the State level.

It is realized that the use and application of remotely sensed data by state and regional planners occurs at several levels of sophistication and complexity. The simplist and perhaps most common use is that of large scale black-and-white photography, and enlargements of these. Less common in practice and experience is small scale color aerial photography. A continuing sequence (generally unknown to planners) involves simple manual color enhancement, then more complex analog processing and enhancements, and finally the highly complex digital enhancements. These latter steps would include primarily satellite as well as aircraft remotely sensed data.

In working closely with the state and regional planning communities in Maryland, this ERTS demonstration project is evolving as planned in the ERTS-1 and proposed follow-on studies, from relatively simple procedures and demonstrated applications,

and is moving towards the more sophisticated. Planners are not only being informed by exposure to the processes, procedures, and potential applications involved, but rather are finding those areas where data of various sources, forms, and processes can be integrated into their operational planning responsibilities.

The majority of efforts to date have addressed the use of high altitude aircraft imagery in order to: (1) provide a useful base upon which the ERTS-1 data can be fully evaluated; (2) consider the extent of resource and land use information available from that data source and its application to the planning process; (3) consider the extent of updating information available compared to other sources of data used in the planning process; and (4) test the applicability of satellite data as an "early warning" device for forecasting land use and/or environmental change and to focus such events on the attention of the concerned planning community.

Specific tasks undertaken to date are reported herein. Present and future efforts progress up the scale of sophistication and complexity, addressing such topics as simple satellite image analysis and color enhancement procedures, interpretation, and application of data to comprehensive state planning.

INTRODUCTION

The principal objective of this study is to demonstrate the utility and application of ERTS-1 satellite and high altitude aircraft imagery to integrated processes of comprehensive state planning. The demonstration experiment is a joint project between the Maryland Department of State Planning (Md. DSP) and Earth Satellite Corporation (EarthSat), and is being conducted in the State of Maryland.

Among the problems which face state and regional planners are the unavailability of many types of geographic data and the process to integrate these data into products and methods useful to planning. Methods are needed which will efficiently and economically provide the land use information required for developing an existing land use inventory and to facilitate future updating of land use change. With additional data, the planning process must also evaluate land capability and future land use suitability.

The present study addresses each of these elements of land use planning and has proceeded in several tasks. First was a complete land use inventory to provide a land use data base for further studies and planning applications. Most of the land use inventory was completed by the USGS Geographic Applications Program (CARETS Project) which has cooperated in coodinating research efforts and results with Md. DSP. The land use inventory was completed by EarthSat by interpretation of existing USDA aerial photography of three counties in Western Maryland and updated to 1972 using NASA-AMES underflight data during the Pre-Launch Preparation period.

Additional tasks relate to the capability and suitability analysis, techniques for updating land use information, temporal analyses of land use change, etc., as shown on Table 1, "Task Status Schedule".

While high altitude aerial photography was used heavily to develop existing land use data base, subsequent studies have focused on the use of ERTS-1 data with minimal reliance on aerial photography. For example, a land use map of the State of Maryland has been produced at 1:250,000 scale based on ERTS-1 interpretation (described in the following discussion).

Data acquired under this project will have longevity in its use by the planning community. Since completion of the State land use inventory, several presentations have been made to various state and regional planning officials who expressed desire to have greater access to the data for their own planning work and responsibilities. This response alone is a significant result of the experiment which demonstrates the innovation of new technologies and processes into the planning community.

A number of additional projects have been carried out in each task shown on Table 1, presented in detail in later discussions, include the following:

1. A supplementary report on the land use classification scheme adopted by Maryland was prepared.

2. USGA CARETS and Western Maryland land use maps were

TASK STATUS SCHEDULE

Table 1.

Task	Title	Status	Comments
A	1970 Land Use Inventory		
A.1	Identify sub-areas within Maryland	Completed	Seven regions, aggregating 23 counties.
A.2	Adopt Land Use Inventory Scheme		Department of Interior classification (USGS Circular 671).
A.3	Guidelines for Aerial Photo Interpretation		
A.4	Classification of State Land Use	Completed	USGS-GHP (CARETS) maps cover six regions (20 counties); the seventh region, Western Maryland, has been completed. A map converted to 1:126,720 scale.
A.5	Refine Existing Inventory	Underway	Efforts have investigated time required to breakdown several categories on underflight photography; ERTS interpretation continuing.
A.6	Ground Truth Where Necessary	Completed	
A.7	Land Use Map Product	Completed	1:125,720 B/W reproducible by regions; one copy color.
A.8	Quantification by Class	Completed	Western Maryland map planimetered; all maps will be digitized.
B	Capability & Suitability Analysis		
B.1	Identify Capability Classes	Completed	Data shown on Table ___ are being assembled for digital analysis.
B.2	Identify Suitability Classes	Underway	Substantially completed, continuing refinement
B.3	Critical Areas	Completed	Subject to revision (Expansion)
B.4	Define Guidelines for Capability	Underway	Algorithms and models for digital analysis being designed
B.5	Define Guidelines for Suitability	Underway	

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Task	Title	Status	Comments
B.6	Determine Capability from Images/Supplementary Data	Underway	
B.7	Determine Suitability from Images/Supplementary Data	Pending	
B.8	Ground Truth Capability	-	Not necessary at this time.
B.9	Ground Truth Suitability	-	Not necessary at this time.
B.10	Capability Map Products	Pending	Digital Analysis Products
B.11	Suitability Map Products	Pending	Digital Analysis Products
B.12	Quantify Capability Maps	Pending	Digital Analysis Products
B.13	Quantify Suitability Maps	Pending	Digital Analysis Products
C	Techniques for Updating Land Information		
C.1	Land Use Inventory	Completed	Techniques developed and effort required estimated based on 4 sample studies for 1972 update.
C.2	Capability Classes	Pending	
C.3	Suitability Classes	Pending	
C.4	Determine Short Range Data Storage for Images and Interpretation	Completed data	Image catologue of Aircraft and ERTS data for State and regional planning communities.
C.5	Implement C.4	Continuing	Completed for data received through January, 1973.
C.6	Advise on Long Range Information Systems Requirements	Pending	
D	Temporal Analysis of Land Use in Selected Areas	Completed	
D.2	Land Use Inventory Update to 1972		
D.3	Temporal Analysis Map Products	Completed	
D.4	Land Use Analysis Map Products		
D.5	Quantification of D.1		
D.6	Quantification of D.2		
E	Formulation of Land Related Goals and Policies	Underway	

Task	Title	Status	Comments
F	Review of Preliminary Alternative Land Use Plans	Underway	
G	Evaluate Remote Sensing Information		
G.1	Land Use Inventory	Underway	Continuing seasonal evaluations
G.2	Capability Information	Pending	
G.3	Suitability Information	Pending	
G.4	Compare Usefulness of Satellite to other Imagery	Underway	
G.5	Determine Level of Utility of Satellites for Significant Contribution	Underway	
G.6	Compare Incremental Cost/ Savings vs. Common Data Sources	Underway	
H	Future Satellite/Aircraft Coverage and Requirements		
H.1	Future State Activities	Underway	
H.2	Define Sensors, Times, etc.	Underway	
H.3	ERTS-B and other Operational Satellites	Partially Completed	This was initialed in essence (at no cost to the project) when the State of Maryland and EarthSat co-operated in submitting an ERTS-B proposal.

reproduced at a scale of 1:126,720, mosaicked and subsequently divided into 7 planning regions. A color copy of each map has been prepared and will be used for further analysis. The Western Maryland land use map was quantified by class using planimetery.

3. An examination of high altitude U-2 photography obtained on August 22, 1972 and December 6, 1972 was conducted to refine existing inventories for finer category discrimination in urban nd suburban ares. Analysis included areas in the cities of Bowie, Laurel, Columbia, and Baltimore.

4. Several critical areas in the State were subjected to detailed examination using ERTS underflight imagery: Worchester County shoreline; Deep Creek Lake area in Garrett County; all marinas along the Chesapeake Bay shores; selected areas in the Baltimore-Washington urban corridor. In each area an update and refinement of the land use inventory was conducted and maps prepared.

5. For ease and accuracy in determining aerial and satellite image coverage for the State, all imagery received have been catalogued and documented by location, cloud cover, film type, scale, and date of coverage. A reference catalog of high altitude aerial photography has been prepared and will be continually updated. This catalog is designed to meet the needs of the planning community by facilitating reference to all available imagery.

SUMMARY OF ACTIVITIES

Land Use Classification Scheme

In conjunction with the Department of State Planning's efforts in preparing a State Land Use Plan, the Department has developed a land use inventory and classification scheme which is also responsive to other State agencies and sub-State jurisdictions.

Because of the general and comprehensive nature of the State's interest in land use planning, and data sources that can be economically utilized at the State level, the classification scheme developed differs somewhat from traditional land use classification schemes.

The Land Use Classification Scheme adopted for the Maryland Land Use Inventory was developed by the U. S. Geological Survey (Anderson, J.R., E.E. Hardy, and J. T. Roach, 1972)

This classification scheme was developed on the assumption that different levels of classification would be derived from different sources.

The land use classifications discussed herein are based on interpretation of available high altitude-small scale imager, and may be ambiguous relative to ground based interpretations. The level of generalization in the classification scheme, the small scale of the basic imagery, and the scale of reproduction of the final map are appropriate for a map illustrating regional land use patterns.

In general, the relationship can be tabulated as:

Classification Level	
I	Satellite Imagery
II (to be developed)	High Altitude and Satellite Imagery combined with topographic maps.
III (to be developed)	Medium Altitude remote sensing (1:20,000) combined with detailed topographic maps and substantial amounts of supplemental information.
IV	Low Altitude imagery with most of the information derived from supplemental sources.

The Department of State Planning has produced a 1970 land use inventory of the State, with the cooperation of the U. S. Geological Survey, that includes classification levels I and II. An attempt will be made to generally disaggregate certain level II categories, for specific areas of interest. Classification I and II for State of Maryland land use classification scheme is shown in Table 2. It should be noted that 1970 and updated 1972 land use maps categorize forest land into the following sub-categories:

41. Heavy Crown Cover (40 percent and over)
42. Light Crown Cover (10 percent and over)
43. Shrub

All subsequent land us maps will be based on Level II categories as shown in Table 2. The Department has also developed a tentative color code for this classification scheme (Table 3). Colors have been designated for those classes which the Department believes will occur in some location throughout the State.

State of Maryland Land Use Map

A land use inventory for twenty counties and Baltimore City was prepared in an experimental program by the U. S. Geological Survey's Geographical Applications Program for computer coding and information systems as part of their efforts in the Central Atlantic Regional Ecological Test Site (CARETS). Discussions held with the USGS Georgraphic Applications Program resulted in a cooperative arrangement and CARETS land use maps were acquired in January, 1973. The Department of State Planning has agreed to edit the CARETS inventory using its regional field personnel and an intergovernmental planning organization.

The land use inventory of Maryland was extended to include Western Maryland (Allegheny, Garrett, and Washington Counties), and a map for Western Maryland was prepared by Earth Satellite Corporation.

Table 2. LAND-USE CLASSIFICATION SYSTEM FOR USE WITH REMOTE SENSOR DATA

Level I		Level II	
10.	Urban and Built-up Land	11.	Residential
		12.	Commercial and services
		13.	Industrial
		14.	Extractive
		15.	Transportation, Communications, and Utilities
		16.	Institutional
		17.	Strip and Clustered Settlement
		18.	Mixed
		19.	Open and Other
20.	Agricultural Land	21.	Cropland and Pasture
		22.	Orchards, Groves, Bush Fruits, Vineyards, and Horticultural Areas
		23.	Feeding Operations
		24.	Other
30.	Rangeland	31.	Grass
		32.	Savannas (Palmetto Prairies)
		33.	Chaparral
		34.	Desert Shrub
40.	Forest Land	41.	Deciduous
		42.	Evergreen (coniferuous and other)
		43.	Mixed
50.	Water	51.	Streams and Waterways
		52.	Lakes
		53.	Reservoirs
		54.	Bays and Estuaries
		55.	Other
60.	Nonforested Wetland	61.	Vegetated
		62.	Bare
70.	Barren Land	71.	Salt Flats
		72.	Beaches
		73.	Sand Other Than Beaches
		74.	Bare Exposed Rock
		75.	Other

B.

Table 3. TENTATIVE COLOR CODE FOR STATE OF MARYLAND LAND USE CLASSIFICATION SCHEME

Classification Number	Color	Eagle Prismacolor
11	yellow orange	917
12	scarlett lake	923
13	dark grey	966
14	black	935 944
15	carmine red	926
16	pink	929
17	light purple	934
18	dark purple	931
19	light flesh	927
21	green brice	913
22	apple green	912
23	orange	918
24	true green	910
41	grass green	909
42	light green	920
51	sky blue	919
52	aqua marine	905
53	ultra marine	902
54	sky blue	919
61	terra cotta	944
62	sepia	948
72	dark brown	946
73	raw umber	941
74	gold	950

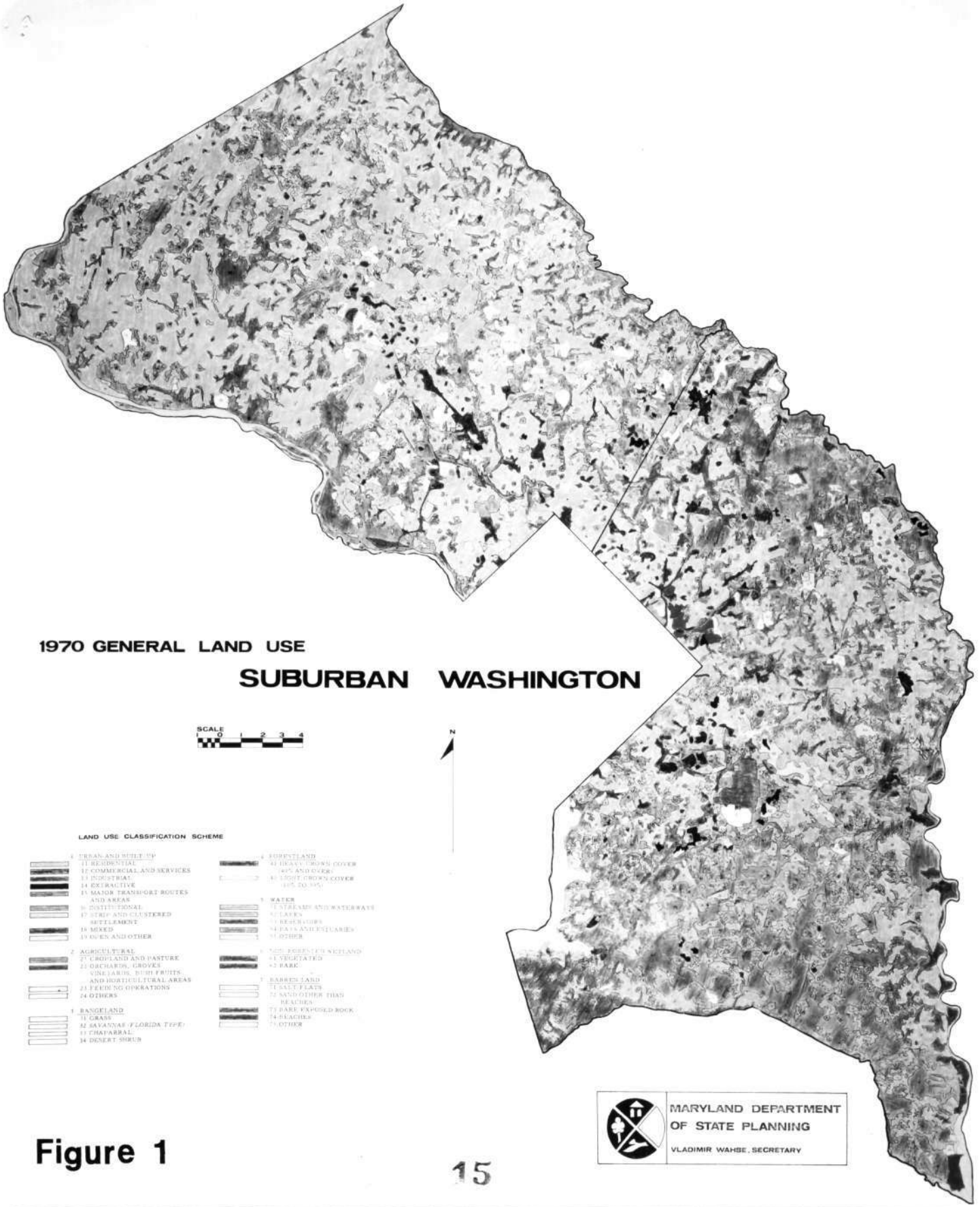
1970 GENERAL LAND USE
SUBURBAN WASHINGTON
SCALE
1 0 1 2 3 4
N
LAND USE CLASSIFICATION SCHEME
1 URBAN AND BUILT-UP
11 RESIDENTIAL
12 COMMERCIAL AND SERVICES
13 INDUSTRIAL
14 EXTRACTIVE
15 MAJOR TRANSPORT ROUTES AND AREAS
16 INSTITUTIONAL
17 STRIP AND CLUSTERED SETTLEMENT
18 MIXED
19 OPEN AND OTHER
2 AGRICULTURAL
21 CROPLAND AND PASTURE
22 ORCHARDS, GROVES, VINEYARDS, BUSH FRUITS AND HORTICULTURAL AREAS
23 FEEDING OPERATIONS
24 OTHERS
3 RANGELAND
31 GRASS
32 SAVANNAS (FLORIDA TYPE)
33 CHAPARRAL
34 DESERT SHRUB
4 FORESTLAND
41 HEAVY CROWN COVER (70% AND OVER)
42 LIGHT CROWN COVER (10% TO 70%)
5 WATER
51 STREAMS AND WATERWAYS
52 LAKES
53 RESERVOIRS
54 BAYS AND ESTUARIES
55 OTHER
6 NON-FORESTED WETLAND
61 VEGETATED
62 BARE
7 BARREN LAND
71 SALT FLATS
72 SAND OTHER THAN BEACHES
73 BARE EXPOSED ROCK
74 BEACHES
75 OTHER
MARYLAND DEPARTMENT OF STATE PLANNING
VLADIMIR WAHSE, SECRETARY

Figure 1


GARRETT COUNTY
ALLEGANY COUNTY
WASHINGTON COUNTY
GENERAL LAND USE MAP
WESTERN MARYLAND, 1972
LAND USE CLASSIFICATION SCHEME
INFORMATION TO USERS
MARYLAND DEPARTMENT
OF STATE PLANNING

Figure 2

Black and white renditions of the Western Maryland map and the Suburban Washington map (based on USGS data) are reproduced in Figures 1 and 2.

Because of the absence of 1970 high altitude aerial photography of Western Maryland, various photographs dating from 1962 to 1972 were used. An initial interpretation was made using air-photo index sheets of 1962 and 1970, USDA-ASCS, reproduced to uncontrolled mosaics of approximately 1:62,360 scale. These data were immediately updated using 70 mm color infrared photography at a scale of (1:450,000) acquired by a NASA U-2 aircraft on April 4, 1972, June 7, 1972 and August 22, 1972. Ground truth surveys were also conducted to classify specific interpretations ambiguities.

Quantification of Western Maryland Land Use Map

Land use categories as delineated on the general land use map of Western Maryland have been quantified using a Martin-Kuykendall area calculator. This measurement system is based upon an electric counting device rigged to a transparent 100 square/inch grid. The grid, when used as an overlay on maps at a scale of 1:126,720 will delineate cells containing 25.60 acres.

DSP selected the electoral district as the unit data collection aggregation. The three counties, representing Western Maryland contain 75 electoral districts ranging in size from 64 acres to 44,928 acres. The procedure adopted, quantified each of the subordinate land use classes within an electoral district and summed the totals. The area of the single dominant land use class within that district was defined as the remainder of the subordinate sums from the total district district area. Using this technique, associated measuring errors

were accumulated within the dominant land use class.

Garrett County was quantified using a map scale of 1:62,500. Sixteen electoral districts totalling 427,648 acres were quantified in 7:10 hours, or an average of 59,644 acres per hour.

Twelve electoral districts totalling 35,008 acres in Western Allegany County were quantified using two map scales. At the map scale of 1:62,500 it took 2:15 hours to complete the quantification, or an average of 15,559 acres per hour. This per hour coverage is about 1/4 that covered in Garrett County; the difference can be attributed to smaller class size and more intricate class relationships existing in Western Allegany County. This same area was quantified in 0:40 hours when using a map scale of 1:126,720, or an average of 52,250 acres per hour. Although the quantification measurements obtained using the 1:126,720 scale map generally over estimated, the differences were of such a degree that would not significantly alter the existing relationships. It was then decided to conduct the remaining quantification on 1:126,720 maps.

Alleghany County, containing 33 electoral districts totalling 273,728 acres, was quantified in 2:55 hours, or an average of 91,242 acres per hour. Washington County, with 301,440 acres divided into 27 electoral districts, was measured in 4:25 hours, or an average of 46,950 acres per hour.

The diversity in per hour coverage is largely a result of the number of classes within a district and percentage of the district represented by the dominant land use class. It is clear that land

use quantification conducted on a map scale of 1:126,720 is meaningful and the errors associated with this smaller scale do not significantly alter existing land use class proportions.

Results of the quantification by county for each land use category are shown in Table 4 and results for each electoral district are shown in Table 5, 6, and 7.

Refinement of Land Use Classifications in Urban and Suburban Areas

A detailed analysis of selected small sample areas in the Baltimore-Washington corridor has been carried out as part of a study to assess: (1) whether further subdivision within U.S.G.S./ CARETS Level II and use classes may be made at a finer level, (2) whether enough change is present to warrant more extended mapping on the part of the State, and (3) small sample areas for detailed comparison with ERTS-1 imagery at a later date. The detailed analysis was conducted for areas in the cities of Bowie, Laurel, Columbia, and Baltimore.

Existing high altitude ERTS underflight RC-10 (1:130,000) aerial photography was examined to determine the contribution this high altitude imagery could make in refining land use classification involving residential categories. RC-10 photography obtained in August and December, 1972 was available for interpretation.

Visual discrimination amoung different types of residential dwellings is readily discernable from the imagery. See Fig. 3.

Interpretation of individual dwelling types was conducted with no ground truth assistance, and thus should be treated accordingly.

It is suggested that in order to optimize residential classification refinements, delineations should be noted on a map whose scale is congruent with the size of residential developments. These refinements, when delineated on a map scale of 1:126,720, appear as rather indiscriminant locations.

Figure 3: Sample Area Within Baltimore City

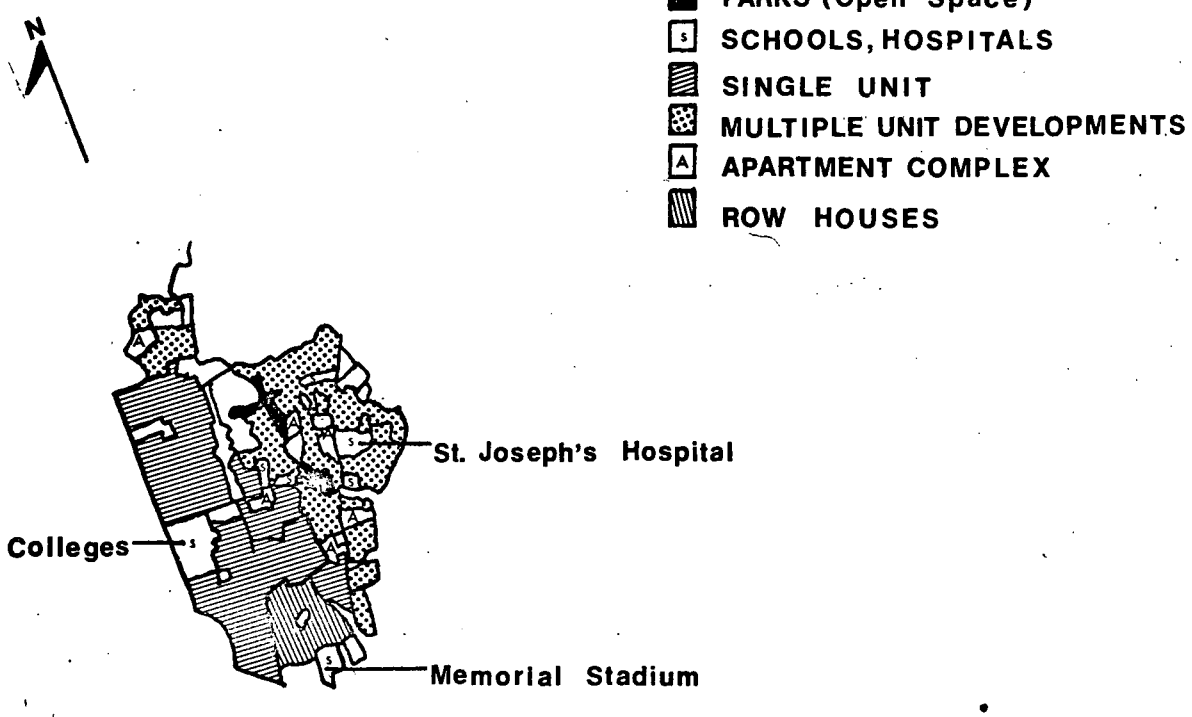

Table 4. TABULATION OF LAND USE CATEGORIES FOR WESTERN MARYLAND COUNTIES

County	Total Acres	11	12	13	14	15	16	17	18	19	21	22	41	42	51	52	53	54
Allegany	293,728	7,142	870	692	1,743	206	257	5,121	--	77	43,340	1,331	211,298	1,305	--	128	154	--
Garrett	427,648	1,115	319	100	4,473	93	50	3,507	62	31	110,022	--	301,565	3,245	--	517	2,548	--
Washington	301,440	5,966	1,564	512	589	1,714	1,152	8,114	--	77	177,668	9,600	87,213	1,154	5,938	128	51	--

Table 5. TABULATION OF LAND USE CATEGORIES BY ELECTORAL DISTRICT FOR ALLEGANY COUNTY, MARYLAND

County District	Acres Total Area	ACRES DELINEATED BY LAND USE CLASSIFICATION CATEGORY																
		11	12	13	14	15	16	17	18	19	21	22	41	42	51	52	53	54
Allegany County																		
1	31,936										4,608		27,328					
2	32,320	51	51					179			5,043	256	26,740					
3	44,928							256			8,909		35,763					
4	1,920	447	179	77		128	77				179		256					
5	5,120	742						128			819		3,354	77				
6	3,584	717	51	230		26	77	384			77		2,022					
7	18,880	384	51					589			3,302		14,452	102				
8	3,776	461	51	77	384			102			333		2,368					
9	4,800	282	26		282			26			640		3,544					
10	2,560	179			26			77			307		1,920	51				
11	1,152	77									102		973					
12	640	230	77			26					179		102	26				
13	7,936	282	51		77			307			1,766		5,402	51				
14	64																	
15	3,968	102			77			77			384		3,328					
16	20,352			205				384			3,814	589	15,360	77				
17	4,224				154			128			589		3,353					
18	4,416				77			256			1,075		2,982	26				
19	2,688				179	26		230			1,562		512	179				

Table 5. - Continued

County District	Total Area	ACRES DELINEATED BY LAND USE CLASSIFICATION CATEGORY																
		11	12	13	14	15	16	17	18	19	21	22	41	42	51	52	53	54
Allegany County																		
20	1,552	256	51	26	77			102			384		6,656					
21	11,840							384			3,533	102	7,667				154	
22	3,136	358					51	77			640		1,959	51				
23	2,432	358	51					282			486		1,255					
24	4,416	205	26					154			973		3,058					
25	2,432							102			333		1,869			128		
26	1,856	282	26		256		26				102		1,164					
27	3,712				26			154			538		2,764	230				
28	512	26						51			26		409					
29	13,312	1,075	128	26	26		26	282		77	717		10,622	333				
30	2,368			51	102			77			205		1,933					
31	9,600	77	51					307			538		8,525	102				
32	1,088	51						26			230		781					
33	14,208										947	384	12,877					
Total County	293,728	7,142	870	692	1,743	206	257	5,121	--	77	43,340	1,331	211,298	1,305	--	128	154	--

Table 6. TABULATION OF LAND USE CATEGORIES BY ELECTORAL DISTRICT FOR GARRETT COUNTY, MARYLAND

County District	Acres Total Area	ACRES DELINEATED BY LAND USE CLASSIFICATION CATEGORY																
		11	12	13	14	15	16	17	18	19	21	22	41	42	51	52	53	54
Garrett County																		
1	34,752				648			791			6,635		26,497	181				
2	33,664	199	25					187			8,498		24,288	31			436	
3	43,776	93	44		467			330			11,700		30,824	168		150		
4	27,136	50	19	44	1,302			75			2,249		23,017				380	
5	33,152						19	162			13,064		19,876	31				
6	42,432		75					554			8,716		31,729	760			548	
7	8,896	156	12				19	249		31	6,180		1,701				548	
8	44,800				411				62		14,354		29,418	554				
9	14,464				193	93		106			5,314		8,472	87		199		
10	19,968				910			299			5,420		13,096	243				
11	16,960				206						2,822		13,863	69				
12	25,280										6,012		18,558	673		37		
13	10,688	93	25		336						1,458		8,689	87				
14	38,400	150	50	25				754			7,850		28,711	249		25	586	
15	17,792										3,831		13,849	112				
16	15,488	374	69	31			12				5,919		8,977			106		
TOTAL County	427,648	1,115	319	100	4,473	93	50	3,507	62	31	110,022	--	301,565	3,245	--	517	2,548	--

Table 7. TABULATION OF LAND USE CATEGORIES BY ELECTORAL DISTRICT FOR WASHINGTON COUNTY, MARYLAND

County/ District	Acres Total Area	ACRES DELINEATED BY LAND USE CLASSIFICATION CATEGORY																
		11	12	13	14	15	16	17	18	19	21	22	41	42	51	52	53	54
Washington County																		
1	16,128	205	51					461			9,959		4,454		998			
2	9,216	282	128	26	179	230		179			6,989	51	896		256			
3	1,152	see #25																
4	18,176	102	26			102		256			12,698	179	4,659		154			
5	34,240	230	256	51	26	333	26	614			4,480	6,118	20,545		1,510	51		
6	13,376	282	26		51		51	435			9,741	128	2,662					
7	12,928	205	26				26	307			6,168	1,357	4,762	51		26		
8	14,336							435			8,064		5,683	154				
9	12,160	102	26					256			10,982	128	384	282				
10	10,496	410	102	51		154	154	333			9,266	26	77					
11	11,264					51	51	230			2,611	77	7,373		922			
12	11,264							512			10,010		282	256	102			
13	15,040	154			128			435			13,069		1,152		51			
14	9,024							179			4,109	922	3,277			51		
15	31,168		26			51	51	717			8,422	410	20,697	26	819			
16	14,016		26		51	102		640			8,666		4,429	51			51	
17	1,024	see #25																
18	12,992		51		154		51	486			10,765	102	922					
19	8,128							205			6,387		1,408	128				

Table 7. - Continued

County District	Acres Local Area	ACRES DELINEATED BY LAND USE CLASSIFICATION CATEGORY																
		11	12	13	14	15	16	17	18	19	21	22	41	42	51	52	53	54
Washington County																		
20	14,272							333			10,515		2,221	77	1,126			
21	1,024	see	#25															
22	448	see	#25															
23	17,152	410	26	26		307		717			14,821		819	26				
24	3,072	102				77		77			2,714		102					
25	832	1,485	640	230		179	205			77	1,664							
26	3,264	717				128	77	179			1,728		358	77				
27	5,248	819	154	128				128			3,840	102	51	26				
TOTAL County	301,440	5,966	1,564	512	589	1,714	1,152	8,114		77	177,668	9,600	87,213	1,154	5,938	128	51	

A 1972 update of land use classifications within the selected areas was initiated and new developments, not originally recorded on the 1970 Land Use Maps, were delineated.

Accurate logs of time required for detailed interpretation analysis, discussed in the following, were maintained. Interpretation costs (time per unit area) are not presented because of variance both between areas and between residential development types. In Bowie, for example, the small number of multiple unit developments in only two specific locations allowed for a more rapid analysis per unit area then in Laurel where there is a more complex relationship among various residential development types. Inner-urban complexities of the Baltimore study area required even more time per unit area. The four areas analyzed, however, represent a reasonable cross section of residential type and density, Interpretation time for each area is as follows: Bowie - 3 hours; Laurel - 6 hours; Columbia - 5 hours; Baltimore City - 6 hours; Total - 20 hours. If more specific determination of residential development types was warranted, additional time for appropriate ground truth measures would be incorporated into the interpretation program.

Bowie - A refinement in the land use categories for Bowie will not substantially alter the existing CARETS delineations. Only two rather small areas of townhouse developments were found within Bowie. The overwhelming majority of residential structures occur as detached single unit dwellings.

An update of land use delineations for Bowie does, however, merit mention. A detached urban community in southern Bowie shows a northerly migration of recent urban development towards Bowie proper. All new development as observed on December 1972 photography appears to be detached single unit dwellings. Evidence of clearing and grading of additional agricultural land for development is apparent.

Laurel - Refinement of land use class #11 (residential) can be readily determined from August and December RC-10 photography. Since there exists a variety of multiple unit residence developments within Laurel, this refinement should be beneficial for planning purposes. Among the type of multiple unit residences observed are: (1) offset quadraplex townhouses, (2) duplex townhouse clusters, (3) apartment complexes, (4) undeterminable multiple units, and (5) trailer courts.

These interpretations were made on the basis of structural characteristics and relationships shown on December RC-10 photography. In order to indicate these refinements on maps at a scale of 1:126,720 the classes were lumped together under the category of "multiple residences"; but as the photo depicts, more discrete delineations can be made from the imagery.

A land use update concerns few small parcels previously called #19 (open and other) which have been developed since 1970.

Columbia - A refinement within multi-family residential land use categories for Columbia will provide better information for planning inputs. However, discrimination between types of multiple

residential units on 1:130,000 imagery is difficult. Thus, all multiple unit residential structures were placed into one category. The Eastern sections of Columbia reveal growth of residential development on land that was classified open and other and agricultural croplands.

Baltimore City - The target area selected within Baltimore City is bounded to the north by Northern Parkway, to the south by 33rd Street, to the east by Hillen Avenue-Perring Parkway, and to the west by Charles Street.

Since dense vegetation cover on August imagery obscured much of the urban infrastructure, the December imagery was more useful for analysis of residential categories. A refinement of class #11 (Residential) seems feasible since within this area four types of residential development were delineated. These are: (1) detached single unit dwellings, (2) multiple unit developments - duplex and quadraplex structures, (3) apartment complexes, and (4) row houses. Since there has not been any detectable change in land use since 1970, a 1972 update does not seem warranted.

DETAILED ANALYSIS OF CRITICAL AREAS

Worcester County, Maryland - Marinas

In order to provide a base for later evaluation of ERTS-1 and high altitude imagery for providing any evidence of marina and associated developments, an analysis was made of the location and classification of coastal marinas. High Altitude ERTS underflight RC-10 imagery (1:130,000) was studied to determine the location of all

coastal marinas in Maryland. Marinas were categorized on the basis of different associated facilities. A marina is defined as a boat basin that has docks, moorings, supplies, and other facilities for small boats. Recognition/interpretation parameters were based upon coastal locations which had an abnormally large aggregation of small boats. Many private individual docking facilities are prevalent on the Chesapeake Bay coastline, and when recognized as such were not delineated as marinas.

Classification of coastal marinas is based upon the relationship of the marina facility with the shoreline, and hence with marina expansion impacts on both the environment and navigation. The marina classification is as follows:

1. "Dredge-Channel" marinas - These marinas are constructed by dredging a channel into shoreline property, or by a dredge-and-fill process of shoreline area. Enlarging the capacity of this type of marina would probably involve additional dredging of shoreline areas.

2. "Jetty" marinas - These are constructed by driving piling into shallow water coastal areas and erecting jetties to them which extend to the shoreline. Minimal alteration to the shoreline should result from this construction. Expanding the capacity of this type of marina would probably involve either extending the existing jetties or constructing new ones. Marina facilities at Riviera Beach and Galesville depict "Jetty" marina types.

3. Combination marinas - These marinas are essentially a combination of the two aforementioned types. The facility is an inland dredged channel or bay which is large enough to accommodate piers or

jetties. A good example of the combination marina exists along highway 50/301 which unites Kent Island with the Mainland of Queen Anne County.

August 22, 1972 RC-10 photography provided the best detection capabilities of coastal marinas. The marinas were usually full of boats, and boating activity was more prevalent than on December coverage. All of Maryland's coastline was studied to locate marina positions. Locations were plotted on the USGS CARETS 1970 Land Use Maps at a scale of 1:126,720. A breakdown of marina types per planning region is presented, with a statewide total in Table 8.

TABULATION OF MARINA TYPES PER PLANNING REGION

	Dredge Channel	Jetty	Combination
Baltimore Region	7	108	4
Upper Eastern Shore Region	14	32	14
Lower Eastern Shore Region	12	13	3
Southern Region	5	19	4
STATE TOTALS	38	172	25

The interpretations were compared to existing sources for similiar information by DSP staff. These alternate sources included

1. Alexander Drafting Co. - Salt Water, Sport Fishing and Boating in Maryland 1972.

2. University of Maryland - Agriculture Experimentation Station, "Economic Analysis of Marinas in Maryland" 1969.

The comparison revealed a great disparity in the enumeration of coastal marinas in Maryland within the three primary sources. The most obvious reason for this is the variation in the definitions of what facilities are enumerated as marinas.

Marinas in Maryland - Classified facilities with 10 or more

slips, while Boating in Maryland guide listed every facility that the owner wished to be listed, regardless of berths. The temporal differences also introduced disparities.

In summary the three sources in combination provide a highly accurate accounting of marina activity on the Maryland Chesapeake Bay. The imagery analysis providing an important additional dimension (the potential environmental problems of maintenance and expansion) and the benefit of a low cost (interpretation time) inventory.

Worcester County, Maryland Shoreline

High altitude RC-10 imagery (1:130,000) acquired in August, 1972 was analyzed to determine the extent and types of residential development along the County's northern shoreline. A large part of this shoreline is bounded by a wetlands environment. Along with delineating wetlands, locations of coastal residential developments were plotted on the 1970 USGS CARETS Land Use Map.

Most of the coastal residential areas appear to be in initial stages of "Venice type" developments. This residential development type is characterized by a regular arrangement of land-fill strips dissected by dredged channels which intersect a large water body, providing water access for all or most residential units. Detached single unit residences are usually associated with thistype of development.

All but two areas are in an early stage of completion. In most cases channel networks have been dredged and landfill foundations have been built up, but construction of dwellings has not been started. While most new developments are small, there exists in

northern Worcester County along Highway 90, currently, the largest new coastal residential development in the State. Along the coastline, wetland dredging and subsequent filling is resulting in a "Venice-type" development, while adjacent to this development type an elaborate road network has been established. At the date of the initial photography, August 1972, there does not appear to be any residential dwellings constructed within the area.

Deep Creek Lake - Garrett County

A detailed analysis of the Deep Creek Lake region in Garrett County was scheduled to be undertakern. However, available coverage of the area (August 1972) has approximately 60 percent of the lakeshore and surrounding area obscured by cloud cover. A study of the visible sections of the area was concentrated on the northern end of the lake. Four specific developments were identified: (1) the Marsh Mountain/Deep Creek ski area with ski runs and trails, (2) a regularly arranged row of idential residential multiple units, perhaps a condominim comples, (3) a large central structure surrounded on three sides by parking area possibly associated with what appears to be a marina, suggesting a hotel/resort facility, and (4) a fairgrounds or horse racing complex. The remainder of the northern lake front appears occupied by private residences, with the eastern side showing a higher number of large buildings, possibly individual condominiums.

A new analysis of the Deep Creek area will be made shortly with recently acquired (December, 1972 - January, 1973) high altitude ERTS-1 underflight imagery. This material will be used for

detailed analyses of multi-date ERTS imagery and to evaluate whether ERTS may be used for gross monitoring of changes in sensitive areas.

Baltimore-Washington Corridor

A detailed analysis of selected sample areas in this corridor was conducted and will be used for detailed evaluation of ERTS-1 capabilities for monitoring urban-suburban change. The discussion of this analysis was presented in the previous section - Refinement of Land Use Classification in Urban and Suburban Areas.

CAPABILITY/SUITABILITY ANALYSIS

Land in a natural state is capable of sustaining a variety of activities and various levels of that activity, and it is quite clear that comprehensive land use planning is required to optimize and compromise among often conflicting land and resource uses. Suitability analysis refers to determination of developments and changes in land use implied by projections, planning standards, past events and conditions, and how these impact with sites available for construction and available natural resources.

Considerable quantities of highly useful ground truth data presently exists in Maryland in the form of various maps, records, statistics, and reports. These materials are presently being utilized directly in analyses of ERTS-1 imagery for each tasks in Table I. The present form of the materials makes their full utilization difficult and inefficient. Several solutions for this dilemma have been considered and explored. Following a thorough investigation (which was discussed in detail in the project's Data Analysis Plan dated February 10, 1973) of two alternative approaches for collecting,

assembling, and representing data - a direct map overlay (analog system) and a geo-base computer system (digital) it was concluded desirable to develop a digital analysis would have a multi-option flexible base for comparison with ERTS-1 imagery. With such a proposed base, Maryland would be unique among the States in its ability to output a variety of items for direct overlay of ERTS-1 data in transparency format at scales of 1:126,720 or 1:250,000.

The proposed computer file information would include 15 variables, each digitalized in the form of a grid cell matrix with rows and columns used for reference to the Maryland State Plan coordinate system. It is suggested that each grid cell would be 2,000 x 2,000 feet or equal or 91.82 acres. Desirable input variables include: surface water, engineering geology, intake beds, natural soil groups, slopes, existing roads and railroads, State and Federal land ownership, existing land use, mineral resources, sewers, county electoral district, vegetation maps, wildlife zones, critical areas, and historic sites each of which exist in various maps and documents utilized in State planning processes.

If additional funds requested are granted to carry out this proposed investigation, this system will have the capability to internally match or overly data inputs to produce ground truth composites for comparison with satellite imagery. The types of comparisons and study which may be achieved with overlay of such items with multi-season ERTS imagery is clear. The digital output map will provide a series of cutting tools against which analog ERTS-1 data may be systematically examined for insights on ways in which a mutually supportive system for State planning may be evaluated.

EVALUATION OF ERTS-1 DATA

ERTS-1 State Land Use Map

This study was conducted to demonstrate the utility of ERTS-1 data for preparing and updating land use maps based on the land use classification system adopted by the State of Maryland. Specific attention was directed towards extracting Level I information (Table 2) from ERTS-1 imagery for one point in time - January, 1973 (Figure 4). Future efforts will be directed towards demonstration of the capability of extracting from satellite imagery, to the extent possible, level II information, and the capability to monitor land use change with ERTS-1 data.

Land Use Classification System

The land use classification system adopted by the State of Maryland DSP was patterned after that proposed by Anderson, et al. (1972). The Maryland classification system is shown in Table 2. Definitions of the classification categories, from Anderson, et al. (1972) are as follows:

10. Urban and Built Up Land

> "Urban and Built-up land comprises areas of intensive use with much of the land covered by structures. Included in this category are cities, towns, villages, strip developments a long highways, transportation, power, and communications facilities, and such isolated units as mills, mines, and quarries, shopping centers, and institutions".

20. Agricultural Land

> "Agricultural Land may be broadly defined as land used primarily for production of farm commodities. On high-altitude imagery, the chief indications of agricultural activity will be symmetrical patterns made on the landscape by use of mechanized equipment. However, pasture and other lands where such equipment is used infrequently may not show as well-defined shapes as other areas".

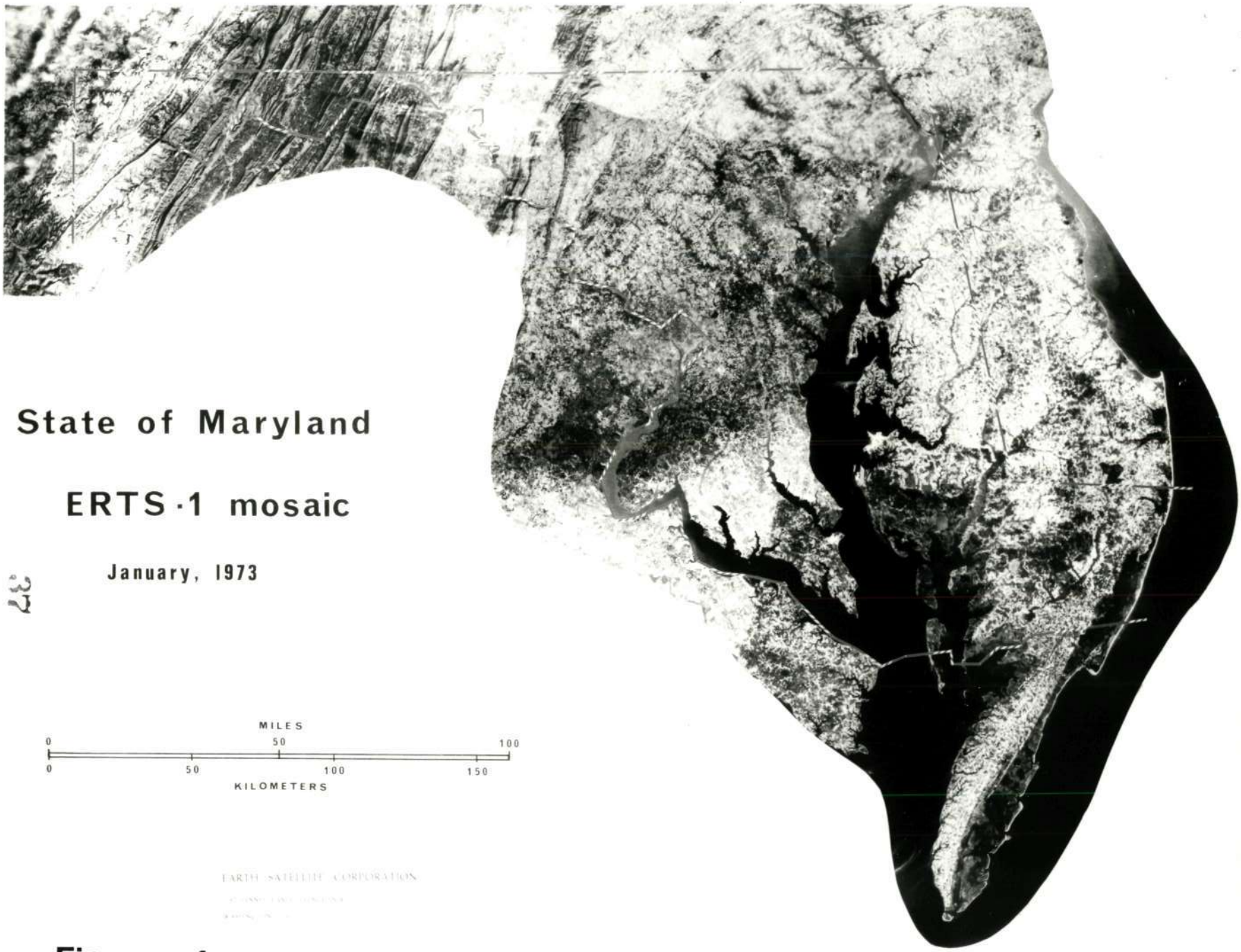
State of Maryland
ERTS-1 mosaic
January, 1973
MILES
0
50
100
0
50
100
150
KILOMETERS

Figure 4

"The interface of Agricultural Land with other categories of land use may sometimes be a transition zone in which there is an intermixture of land use at first and second levels of categorization. Where farming activities are limited by wetness, the exact boundary may also be difficult to locate, and Agricultural Land may grade into swamp Forest Land, Nonforested Wetland, or Water."

30. Rangeland

"Rangeland may be defined as land where the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs, where natural herbivory was an important influence in its precivilization state, and that is more suitable for management by ecological rather than agronomic principles. Some rangelands have been or may be seeded to introduced or domesticated plant species".

Although rangelands are not currently recognized as a land use category by the Maryland Department of State, portions of Western Maryland could be considered as rangeland. These areas are currently being classified as agricultural at Level I.

40. Forest Land

"Forest lands are lands that are at least 10 percent stocked by trees capable of producing timber or other wood products that exert an influence on the climate or water regime".

"Lands from which trees have been removed to less than 10 percent stocking but which have not been developed for other use are also included".

"Lands that meet the requirements for Forest Land and also for a higher use category should be placed in the higher category".

50. Water

"The Water category includes all areas within the land mass of the United States that are predominantly or persistently water covered, provided that, if linear, they are at least 1/8 mile (660 feet or 200 meters) wide and if extended cover at least 1/8 square mile or 40 acres. Water bodies smaller than these minimums are included within the land-use unit in which they are located. Water bodies that are vegetated are placed in the 60 -

Nonforested Wetland category, or in 40 - Forest land is swamp forests exists."

60. Nonforested Wetland

"Nonforested Wetlands consist of seasonally flooded basins and flats, meadows, marshes, and bogs."

"Open saline - and fresh-water areas, sounds, and bays are included under 50-Water. Wetland areas with a 10 percent forest crown cover, or where recent clear cutting has occurred, are placed in 40-Forest Land."

70. Barren Land

"Barren land is land of limited ability to support life and little or no vegetation. In general, it appears to be an area of oily soil, sand, and rocks. Vegetation, if present, is more widely spaced and scrubby than that in the Desert Shrub subcategory of Rangeland except when unusual conditions, such as a heavy rainfall, occasionally result in growth of a short-lived more impressive plant cover."

Land temporarily bare due to man's activities is included in another appropriate land use category.

Data Used

ERTS-1 data from four passes over the State of Maryland in January, 1973 were used for the generalized land use mapping. The following frames were used:

09 January 73, E-1170-15191
09 January 73, E-1170-15193
10 January 73, E-1171-15245
10 January 73, E-1171-15252
11 January 73, E-1172-15303
11 January 73, E-1172-15310
26 January 73, E-1187-15140
26 January 73, E-1187-15142

A mosaic of these images, prepared to accompany presentation of the ERTS land use map (Figure 4) to participating State and regional organizations, is shown in Figure 5.

A false color composite of MSS bands 4, 5, and 7 of frame E-1080-15192, 11 October, 1972 over the Baltimore-Washington area was used

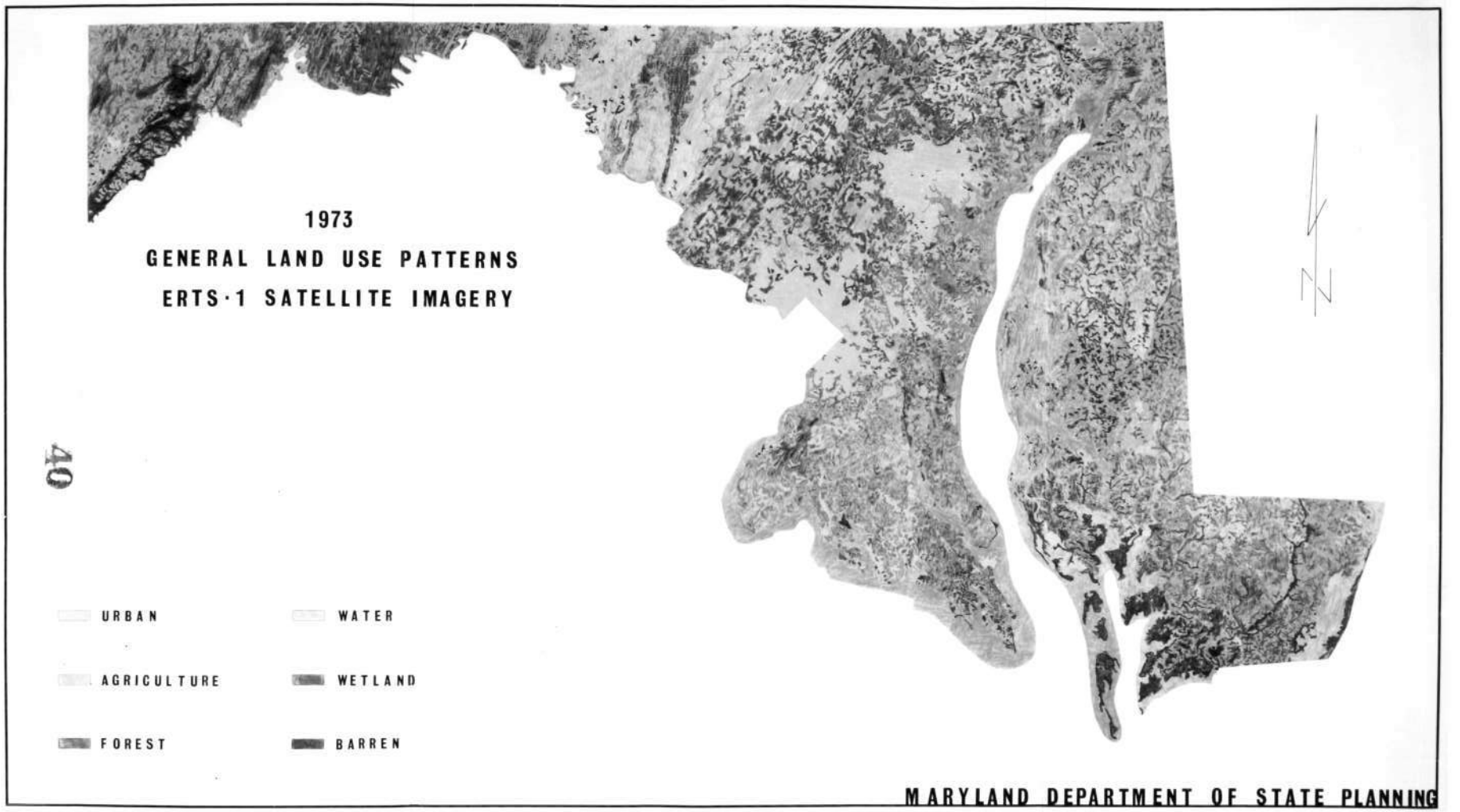
1973
GENERAL LAND USE PATTERNS
ERTS-1 SATELLITE IMAGERY
URBAN
WATER
AGRICULTURE
WETLAND
FOREST
BARREN
MARYLAND DEPARTMENT OF STATE PLANNING

Figure 5

for training and as an aid for separating urban and built-up land from agricultural land.

Limited use of high altitude RC-10 photography acquired in December, 1972 and January, 1973 at a scale of 1:130,000 was made for "pre-training" in dissimilar physiographic regions within the State.

January imagery was selected for this first analysis primarily because it is the only time when the entire state is imaged, essentially cloud free, within a short time span. This was entirely adequate as a basis for interpretation, although false color composites of other dates would have had considerable additive value.

Interpretation Procedures

Image interpretation was performed on 1:250,000 enlargements of MSS bands 5 and 7. Acetate overlays were placed on band 7 and all water, wetlands, and barren lands were plotted. This overlay was then placed on band 5 and all forest, agriculture, and urban-builtup lands were plotted. The false color composite of the Baltimore-Washington area was used to discriminate urban-suburban - agriculture boundaries. Limited use of RC-10 imagery provided "ground-truth" information of selected areas. Paper diazo prints were subsequently made from the acetate overlays, mosaicked, colored, and photographed for illustrative display and presentation purposes.

Results and Discussion

A color statewide level I land use map of approximately 12,300 square miles was prepared in approximately eighteen man days; however, the qualitative analog display of land use categories does not permit quantitative evaluation of its accuracy. Water, barren land, and wetlands imaged with discrete tonal patterns on band 7

at virtually any time during the year. Frame E-1170-15191 contained extensive snow cover which affected the accuracy of wetlands delineations in certain Eastern Shore areas by increasing errors of ommission. Forest lands were easily discernable on band 5. Although forest lands were generally darker toned than agricultural lands over virtually the entire state, the contrast between the two categories was quite variable and required image interpreters to make continuous mental adjustments. The recognition of Forest Lands is considered to be quite accurate. The largest source of error is in discrimination of Agricultural Lands from Urban and Built-up Lands. Agricultural lands generally characterized by harvested fields, bare soil, or senescent short grasses were light toned as were all Urban and Built-up Lands. Agricultural land classification errors are primarily of the commission type, i.e. urban and built-up incorrectly identified as agricultural and urban and built-up land classification errors were generally of the ommission type. These errors could be significantly reduced by utilizing false color composites of MSS bands 4, 5, and 7 of multiple dates.

Level I classification accuracies could be improved as seasonal coverage becomes available. Late spring or early summer imagery should provide considtent tonal contrasts between agricultural lands and urban and built-up lands. Urban and built-up lands would image generally lighter toned than agricultural fields. As the fields are planted and growth begins and pastures green up, they will becomedarker toned on MSS band 5 while any significant tonal change of urban and built-up lands is related primarily to the extent of vegetation development, e.g., canopy growth of shade trees and growth and vigor of lawns and shrubs.

Although imagery acquired in January provided excellent discrimination of forest lands and in many cases permitted separation of hardwoods and conifers over most of the State, snow and accentuated shadows resulting from low solar angles were generally a disadvantage. In Western Maryland where relief is significant, deciduous trees on illuminated south and east slopes were extremely linght tone with only slight contrast to agricultural areas. Accurate classifications of land use categories was difficult on north and west facing slopes which were contained in shadows. Snow in several areas of the state particularly in Southern Maryland and the Lower Eastern Shore, accentuated differences between forest lands and agricultural lands with light accumulations of snow. This was expecially true for evergreen forests and heavily stocked deciduous forests. Snow through fall and accumulation in sparsely stocked forests resulted in lighter tones and subsequent confusion of forest lands and agricultural lands, particularly along the transition zone between snow and no snow (Figure 5).

These preliminary results indicate that ERTS-1 can be used to develop accurate land use maps of level I categories (Table 1). Future analyses could be improved if imagery obtained during late spring over the entire state were used as a mapping base at a scale of 1:250,000. False color composites of bands 4, 5, 7 prepared by diazo or additive color processes at a scale of 1:500,000 or larger would permit accurate classification of agricultural lands and urban built-up lands. If false color composites of ERTS-1 imagery were available for the entire state, little or no high resolution - small scale aircraft photography would be needed for mapping level I categories.

It appears that several categories within level II can be discriminated from ERTS-1 imagery of appropriate false color composites were available. Analysis of the Baltimore-Washington Corridor suggests that false color composites at the appropriate time of year should permit classification of the following level II categories within the appropriate level I category:

Urban and Built-up Lands

- Residential
- Commercial, Industry, Services
- Extractive (strip mines, quarries)
- Transportation, Communication, Utilities
- Strip and Clustered settlement

Agricultural Lands

- Cropland and pasture (?)
- Orchards (?)

Forest Lands

- Deciduous
- Evergreen (coniferous and other)

Water

- Streams and waterways
- Lakes
- Reservoirs
- Bay and estuaries

Nonforested Wetland

- Vegetated

Barren Land

- Beaches

Examples of several level II categories are shown in Figure 5. Although many of these categories can be detected and identified, their small image size on 1:250,000 imagery would not permit accurate delineation in all cases. Additional effort is planned to identify to what extent level II categories can be detected on ERTS-1 imagery and determine to what extent ERTS-1 imagery may be used for monitoring change in those critical areas subjected to detailed analyses with aircraft data. These continued studies will also provide a basis for evaluating the results of the capability/suitability analysis. Data inputs to the capability/suitability analysis are, in many cases, several years old and many changes have occurred. ERTS-1 imagery, with successful delineation of level II land use categories, can be tested as one method for ensuring continuous update of the proposed computer file information used in capability/suitability analyses.

Program for Next Reporting Interval

Work planned for the next reporting interval will proceed along three areas of activity:

1. Further develop a data analysis scheme for detecting land use change and related planning data based on ERTS-1 imagery. This effort will explore several optical and electronic image enhancement procedures and evaluate the usefullness of these techniques for extracting land use change and update information from ERTS-1 imagery. Techniques developed will be tested in several regions to demonstrate the utility of ERTS-1 imagery to comprehensive state planning for providing update information, seasonal changes in landscape and land use, and improved means for extracting level II (and possibly more detailed) information from satellite imagery. A change detection system utilizing both standard and non-standard interpretive procedures

amenable to satellite imagery will provide state planners the basis for specifying areas where greater resolution information (e.g., high altitude photography) may be required for more detailed analysis.

2. A variety of relevant natural resource and environmental data are required by state and regional planners for their development and planning activities. Continuing efforts will be made to optimally determine the capability and applicability of ERTS-1 imagery, identify and specify optimal interpretive procedures, and determine estimates of time and cost information necessary to provide the state and regional planning community with the following geographic resource information:

a. Location of coniferous forest stands

b. Location of deciduous forest stands, and if possible the further separation of Oak-Hickory forests from other deciduous forest types.

c. Location of open-disturbed, bare, non-agricultural lands, i.e., large shopping centers, apartment complexes, other large construction sites, new strip mine areas, recreational developments, etc.

d. Separation of crop and pasture lands in agricultural regions, based on sequential - seasonal image alalysis. Additional analysis, if possible, will include several environmental applications of importance to State and regional planners in Maryland.

3. If the digital capability/suitability analysis is realized as proposed, assemble and prepare necessary data inputs for conducting an automated analysis of geographic data with the State. The proposed analysis will include development of a statewide data bank of natural and cultural resources, mapping of these data, and finally analyzing these data by a series of computer programs.

When completed, the proposed digital analysis will consist of a series of data maps and geographic models which will enable an in-depth analysis of ERTS-1 data for comprehensive state planning purposes.

These dates constitute the major products available to the planning community in their decision making processes. When prepared as digital map overlays at 1:126,720 and 1:250,000 scales, planners and image analysts will be able to most effectively evaluate and compare the information contribution of ERTS-1 imagery enlarged to comparable scales, both regionally (as windows) and statewide. Further, the proposed digital maps would provide the capability for efficiently and effectively updating planner's data files with new information gleaned from ERTS-1 and other remotely sensed data.

These consist of ERTS-1 analysis of multi-spectral and multi-date imagery for investigating areas of excessive sedimentation, faulting and jointing in the Catoctin Mountains, limestone karst features in Frederick County, and comparisons with RC-10 imagery in Worcester County, Garrett County, and the Baltimore-Washington corridor.

Results of each of the above efforts planned in the next reporting interval will further demonstrate the application and capabilities of satellite systems for providing information and techniques for future updating and modification of land use and other environmental data relevant to comprehensive state planning in the Maryland demonstration Test Site.

Conclusions and Recommendations

It is felt that conclusions at this time would be premature, other than to state that ERTS imagery yields considerable detail and data of the natural and cultural environment, and that these data are of applicable use to state and regional planners. Along with the high altitude underflight photography, state and regional planners are integrating imagery and interpretation products into their comprehensive planning processes, and thus demonstrating and developing multiple applications with these new data sources.

Meetings and Papers

Numerous meetings of the cooperative ERTS-1 experiments participants have been held in Baltimore (DSP) and Washington (EarthSat) on a regular basis. In addition, regular meetings are held between DSP and other state and regional agencies to plan cooperative approaches and review project activities and products.

The following meetings outside of the State have been attended by project personnel:

1. Eight International Symposium on Remote Sensing of Environment, Ann Arbor, Michigan, October 2-6, 1972 (Simonett)

2. ERTS Investigators Conference, New Carrolton, Maryland, March 5-8, 1973 (Brooner, Simonett, Antenucci)

3. Association of American Geographers, Atlanta, Georgia, April 16-18, 1973 (Brooner)

4. State Planning Coordinating Committee January 31, February 28, March 28, 1973. Intergovernmental discussions of DSP-ERTS experiment and data collection activities including land use inventory and capability/suitability analysis (Thomas, Antenucci)

In December 1972, DSP issued "A Land Use Classification Scheme for a Statewide Land Use Inventory of Maryland," Land Use Technical Report Number Two.

Recommendations for Technical Changes:

None

Changes in Standing Order Forms

A request was submitted to the ERTS-1 User Services at GSFC, which has been accepted. No additional changes.